

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT WE, Shigeyuki Maruyama, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan, Kazuhiro Tashiro, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan, Makoto Haseyama, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan and Futoshi Fukaya, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan have invented certain new and useful improvements in

SEMICONDUCTOR TESTING DEVICE

of which the following is a specification : -

1 In the related art, various testing methods
for testing a non-resin-sealed bare chip or a resin
sealed semiconductor device having spherically
projecting spherical connection terminals at the bottom
5 surface thereof have been proposed and used.
Hereinafter, each of a non-resin-sealed bare chip and a
resin-sealed semiconductor device will be generically
referred to as a 'semiconductor device'.

 When an electrical operational test of such a
10 semiconductor device is performed, a probe of a testing
device is placed in contact with the spherical
connection terminals. Therefore, it is necessary that
a test of electrical connection is performed in a
condition in which deterioration of the spherical
15 connection terminals is negligible. Further, the test
should have high reliability at low cost.

 One semiconductor testing method in the
related art, for example, uses a semiconductor testing
socket. When the semiconductor testing socket is used,
20 an electrical operational test of a semiconductor
device is performed using a probe. In this testing
method, a testing substrate, on which a plurality of
probes are arranged at positions corresponding to the
positions of the plurality of spherical connection
25 terminals formed on the bottom surface of the
semiconductor device, is used. The projecting ends of
these probes are caused to directly contact the
spherical connection terminals, respectively, so as to
perform the test.

30 This semiconductor testing socket has the
plurality of probes arranged corresponding to the
arrangement of the plurality of spherical connection
terminals of the semiconductor device. Each probe has
bent portion which is bent to a U-shape. When the
35 probe is pressed onto a respective one of the spherical
connection terminals of the semiconductor device, the
bent portion of the probe is deformed, and thus,

1 possible damage to the spherical connection terminal is
reduced.

However, when electrical testing of a
semiconductor device is performed using the above-
5 described probe testing method, the heights of the
spherical connection terminals vary. Thereby, a case
may occur where connection between the projecting end
of the probe and the spherical connection terminal is
not sufficient. As a result, the testing accuracy may
10 be degraded.

Further, even though each probe has the U-
shaped bent portion, when the projecting end of the
probe contacts the spherical connection terminal, the
spherical connection terminal, made of solder, may be
15 deformed.

SUMMARY OF THE INVENTION

The present invention has been devised in
consideration of the above-described problems. An
20 object of the present invention is to provide a
semiconductor testing device which can perform the test
of a device having the spherical connection terminals,
with high reliability, without deformation of the
spherical terminals.

25 A semiconductor testing device, according to
the present invention, for testing a semiconductor
device which has at least one spherical connection
terminal, comprises:

an insulating substrate having an opening
30 formed therein at a position corresponding to the
position of the spherical connection terminal; and
a contact member, formed on the insulating
substrate, comprising a connection portion which is
connected with the spherical connection terminal, at
35 least the connection portion being deformable and
extending on the opening.

In this arrangement, even when the heights of

1 the spherical connection terminals vary, the variation
of the heights of the spherical connection terminals
can be accommodated as a result of the connection
terminals being appropriately deformed. Thereby, it is
5 possible that all the spherical connection terminals
are positively connected with the contact members,
respectively. Thus, the reliability of the test can b
improved.

Further, during the deformation of the
10 connection portions when the connection portions are
connected with the spherical connection terminals,
respectively, the spherical connection terminals slide
on the connection portions. Thereby, even if oxide
film and/or dust are present on the surfaces of the
15 spherical connection terminals and the connection
portions, the oxide film and/or dust are removed as a
result of the sliding contact.

A semiconductor testing device, according to
another aspect of the present invention, which device
20 is used for performing a test on a semiconductor device
having spherical connection terminals, comprises:

a contactor, provided with a single layer of
insulating substrate, in which substrate an opening is
formed at a position corresponding to a respective one
25 of the spherical connection terminals, the contactor
also being provided with a contact portion, which
includes a connection portion with which the respective
one of the spherical connection terminals is
electrically connected, the contact portion being
30 provided on the single layer of insulating substrate so
that the connection portion is located on the opening;
and

a wiring substrate, on which the contactor is
mounted in a manner which permits installation and
35 removal of the contactor onto and from th wiring
substrate, the wiring substrate being provid d with a
first connection terminal which is provid d on a first

1 surface, on which the contactor is mounted, and is
electrically connected with the contact portion, a
second connection terminal which is provided on a
second surface, which is opposite to the first surface,
5 and is connected externally, and an interposer which
electrically connects the first connection terminal
with the second connection terminal.

In this arrangement, the contact portion and
the opening are provided at the position of the
10 insulating substrate facing the spherical connection
terminal, and the wiring substrate for passing an
electric signal from the semiconductor device
therethrough is provided below the insulating
substrate. Therefore, when the semiconductor device is
15 loaded on the contactor, the spherical connection
terminal is connected with the contact portion, and is
electrically connected with the first connection
terminal provided on the wiring substrate via the
contact portion.

20 Further, the first connection terminal is
electrically connected with the second connection
terminal which acts as an external connection terminal
via the interposer. Therefore, by arbitrarily
arranging the interposer, it is possible to arbitrarily
25 set a wiring path which electrically connects the first
connection terminal with the second connection
terminal.

Thus, the wiring path between the contact
portion and the second connection terminal is provided
30 not in the contactor but in the wiring substrate.
Thereby, it is not necessary to provide a multilayer
contactor, and a single-layer contactor can be used.
As a result, it is possible to reduce the cost of the
contactor. Thereby, when the contact portion is
35 degraded as a result of a test being performed
repetitively, and, thereby, replacement of the
contactor is necessary, the replacement can be

1 performed at a low cost. Thus, it is possible to
reduce the cost required for the maintenance.

The contact portion provided on the contactor
causes the electric signal to flow therethrough from
5 the semiconductor device to the wiring substrate below
the insulating substrate directly. As a result, even
when the pitch of the spherical connection terminals is
reduced, it is possible to shorten the length of the
wiring, and, also, it is possible to simplify the
10 wiring arrangement. As a result, it is possible to use
the semiconductor testing device in a high-speed
electric test.

Other objects and further features of the
present invention will become more apparent from the
15 following detailed description when read in conjunction
with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS.1 and 2 illustrate a semiconductor
20 testing device in a first embodiment of the present
invention;

FIG.3 shows a testing socket to which the
semiconductor testing device in the first embodiment is
applied;

25 FIGS.4 and 5 show wafer contactors to which
the semiconductor testing device in the first
embodiment is applied;

FIGS.6A and 6B illustrate a semiconductor
testing device in a second embodiment of the present
30 invention;

FIGS.7A and 7B illustrate a semiconductor
testing device in a third embodiment of the present
invention;

FIGS.8A and 8B illustrate a semiconductor
35 testing device in a fourth embodiment of the present
invention;

FIGS.9A and 9B illustrate a semiconductor

1 testing device in a fifth embodiment of the present
 inv ntion;

 FIGS.10A and 10B illustrate a semiconductor
testing device in a sixth embodiment of the present
5 invention;

 FIGS.11A and 11B illustrate a semiconductor
testing device in a seventh embodiment of the present
invention;

 FIGS.12A and 12B illustrate a semiconductor
10 testing device in an eighth embodiment of the present
 invention;

 FIGS.13A and 13B illustrate a semiconductor
testing device in a ninth embodiment of the present
invention;

15 FIGS.14A and 14B illustrate a semiconductor
testing device in a tenth embodiment of the present
 invention;

 FIGS.15A and 15B illustrate a semiconductor
testing device in an eleventh embodiment of the present
20 invention;

 FIGS.16A and 16B illustrate a semiconductor
testing device in a twelfth embodiment of the present
invention;

 FIG.17 illustrates a semiconductor testing
25 device in a thirteenth embodiment of the present
 invention;

 FIG.18 illustrates a semiconductor testing
device in a fourteenth embodiment of the present
invention;

30 FIG.19 illustrates a semiconductor testing
device in a fifteenth embodiment of the present
 invention;

 FIG.20 illustrates a semiconductor testing
device in a sixteenth embodiment of the present
35 invention;

 FIG.21 illustrates a semiconductor testing
device in a seventeenth embodiment of the present

1 inv ntion;

 FIGS.22A and 22B illustrate a semiconductor testing device in a eighteenth embodiment of the present invention;

5 FIG.23 illustrates a semiconductor testing device in a nineteenth embodiment of the present invention;

 FIG.24 illustrates a semiconductor testing device in a twentieth embodiment of the present invention;

10 FIG.25 illustrates a testing socket in a twenty-first embodiment of the present invention;

 FIG.26 illustrates a semiconductor testing device in a twenty-second embodiment of the present invention;

15 FIGS. 27A, 27B and 28 show elevational sectional views for illustrating a semiconductor testing device in a twenty-third embodiment of the present invention;

20 FIGS. 29A and 29B illustrate one example of a semiconductor testing device;

 FIG. 30 illustrates another example of a semiconductor testing device;

25 FIG. 31 illustrates another example of a semiconductor testing device;

 FIG. 32 shows an elevational sectional view for illustrating a semiconductor testing device in a twenty-fourth embodiment of the present invention;

30 FIG. 33A shows an elevational sectional view for illustrating a semiconductor testing device in a twenty-fifth embodiment of the present invention; and FIG. 33B shows a partially magnified plan view of an insulating substrate of the semiconductor testing device in the tw nty-fifth embodiment of the present invention;

35 FIG. 34 shows an elevational sectional view for illustrating a semiconductor testing device in a

1 twenty-sixth embodiment of the present invention;
 FIG. 35 shows an elevational sectional view
 for illustrating a semiconductor testing device in a
 twenty-seventh embodiment of the present invention;
5 FIG. 36 shows an elevational sectional view
 for illustrating a semiconductor testing device in a
 twenty-eighth embodiment of the present invention;
 FIGS. 37A and 37B illustrate first and second
 variant examples of contact portions, respectively;
10 FIGS. 38A and 38B illustrate a third variant
 example of a contact portion;
 FIGS. 39A and 39B illustrate a fourth variant
 example of a contact portion;
 FIGS. 40A and 40B illustrate a fifth variant
15 example of a contact portion;
 FIGS. 41A and 41B illustrate a sixth variant
 example of a contact portion;
 FIGS. 42A and 42B illustrate a seventh
 variant example of a contact portion;
20 FIGS. 43A and 43B illustrate an eighth
 variant example of a contact portion;
 FIGS. 44A and 44B illustrate a ninth variant
 example of a contact portion;
 FIGS. 45A and 45B illustrate a tenth variant
25 example of a contact portion;
 FIGS. 46A and 46B illustrate an eleventh
 variant example of a contact portion;
 FIGS. 47A and 47B illustrate a twelfth
 variant example of a contact portion;
30 FIG. 48 illustrates a thirteenth variant
 example of a contact portion;
 FIG. 49 shows an elevational sectional view
 for illustrating a semiconductor testing device in a
 twenty-ninth embodiment of the present invention;
35 FIG. 50 shows an elevational sectional view
 for illustrating a semiconductor testing device in a
 thirtieth embodiment of the present invention;

1 FIG. 51 shows an elevational sectional view
for illustrating a semiconductor testing device in a
thirty-first embodiment of the present invention;

5 FIG. 52 shows a plan view for illustrating a
semiconductor testing device in a thirty-second
embodiment of the present invention; and

 FIGS. 53A and 53B show elevational sectional
views for illustrating a semiconductor testing device
in a thirty-third embodiment of the present invention.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

 U.S. patent application Serial No.
09/009,261, filed on January 20, 1998, is incorporated
herein by reference.

15 Embodiments of the present invention will be
described with reference to figures.

 FIGS.1 and 2 illustrate a semiconductor
testing device 10A in a first embodiment of the present
invention. FIG.1 shows a side sectional elevation view
20 of part of the semiconductor testing device 10A. FIG.2
shows a bottom view of part of the semiconductor
testing device 10A. Generally, the semiconductor
testing device 10A in the first embodiment has an
insulating substrate 14 and contact members 18.

25 As shown in FIG.1, a semiconductor device 1
is loaded on the semiconductor testing device 10A. In
this loaded state, the semiconductor testing device 10A
performs an electrical operational test of the
semiconductor device 1. The devices on which the
30 semiconductor testing device 10A performs the test are
semiconductor devices such as the semiconductor device
1 which has the spherical connection terminal 2
(hereinafter, referred to as a 'bump').

35 In the following descriptions, examples using
the semiconductor device 1 having the bump 2 will be
mainly described. However, semiconductor testing
devices in respective embodiments which will be

1 described now can be applied to various devices (for
exampl , a bare chip, a wafer, and so forth).

The semiconductor testing device 10A will now
be described in detail.

5 The insulating substrate 14 is a film member
made of an insulating resin material such as a
polyimide or the like. The insulating substrate 14 is
slightly flexible. A plurality of openings 16 are
10 formed in the insulating substrate 14. The positions
of the openings 16 correspond to the positions of the
bumps 2 formed on the semiconductor device 1,
respectively.

Accordingly, in a condition where the
semiconductor device 1 is correctly positioned over the
15 insulating substrate 14, each bump 2 of the
semiconductor device 1 faces a respective one of the
openings 16 of the insulating substrate 14. Further,
the diameter of each opening 16 is set to be slightly
larger than the diameter of each bump 2. Accordingly,
20 when the semiconductor device 1 is loaded on the
semiconductor testing device 10A, the openings 16
function as guiding holes for the bumps 2.

Each contact member 18 is made of, for
example, a copper (Cu) film, and is formed to have a
25 predetermined pattern using a thin-film forming
technique such as a plating method, an evaporation
method, an etching method, a photolithography technique
or the like. Each contact member 18 includes an
integrally formed wiring portion 20, a terminal portion
30 22, a connection portion 24A and so forth.

The terminal portion 22 is, for example, a
portion with which a connection pin 42, shown in FIG.3,
is connected. Each connection pin 42 connects a
testing board 40 and the semiconductor testing device
35 10A with one another. Normally, each terminal portion
22 is located in proximity to an edge of the insulating
substrate 14. The connection portions 24A are portions

1 which are electrically connected with the bumps 2 of
the semiconductor device 1. Therefore, the connection
portions 24A are provided at the positions which
correspond to the positions of the bumps 2 of the
5 semiconductor device 1, respectively. Each of the
wiring portions 20 connects a respective one of the
terminal portions 22 and a respective one of the
connection portions 24A with one another.

 The outline shape of each connection portion
10 24A is approximately circular and corresponds to the
shape of each bump 2. An opening 26A is formed in each
connection portion 24A at the center thereof. In the
first embodiment, the shape of the opening 26A is a
cross. Because the positions of the connection
15 portions 24A correspond to the positions of the bumps,
as mentioned above, the positions of the openings 16
formed in the insulating substrate 14 correspond to the
positions of the connection portions 24A, respectively.

 That is, the insulating substrate 14 is not
20 present at the position of each connection portion 24A,
and thus, each connection portion 24A is exposed
through a respective one of the openings 16.
Accordingly, when the semiconductor device 1 is loaded
on the semiconductor testing device 10A, the bumps 2
25 are electrically connected with the connection portions
24A through the openings 16, respectively, as shown in
FIG.1.

 As mentioned above, the insulating substrate
14 is not present at the position of each connection
30 portion 24A, and the opening 26A is formed in each
connection portion 24A at the center thereof.
Accordingly, as a result of the connection portions 24A
being pressed by the bumps 2, each connection portion
24A is easily deformed.

35 A method for performing a test on the
semiconductor device 1 using the semiconductor testing
device 10A will now be described.

1 First, the semiconductor device 1 is
positioned with respect to the semiconductor testing
device 10A so that the bumps 2 of the semiconductor
device 1 are aligned with the connection portions
5 (openings 16) of the semiconductor testing device 10A.
Then, as a result of pressing the semiconductor device
1 onto the semiconductor testing device 10A, the bumps
2 are connected with the connection portions 24A.
Thus, the semiconductor device 1 is loaded on the
10 semiconductor testing device 10A. A semiconductor
tester (not shown in the figures) is connected with the
semiconductor testing device 10A. In the state in
which the semiconductor device 1 is loaded on the
semiconductor testing device 10A, an electrical
15 operational test is performed on the semiconductor
device 1 through the semiconductor tester.

Thus, the work of loading the semiconductor
device 1 on the semiconductor testing device 10A is
very simple and easily performed.

20 Further, as mentioned above, each connection
portion 24A with which a respective one of the bumps 2
is connected is deformable. Accordingly, even if the
sizes (heights) of the bumps 2 vary, as a result of the
connection portions 24A being deformed, the variation
25 of the heights of the bumps 2 is accommodated, and
thus, it is possible that all the bumps 2 are
positively connected with the connection portions 24A
(contact members 18), respectively. Thus, the
reliability of the test can be improved.

30 Further, as shown in FIG.1, each connection
portion 24A is deformed when the connection portions
24A are connected with the bumps 2, respectively.
During the deformation of the connection portions 24A,
the bumps 2 slide on the connection portions 24A.
35 Thereby, even if an oxide film and/or dust are present
on the surfaces of the bumps 2 and the connection
portions 24A, the oxide film and/or dust are removed as

1 a result of the sliding contact. Such an effect is
call d a wiping effect.

Thereby, it is possible to make the surfaces
of the bumps 2 and the connection portions 24A clean
5 when the semiconductor device 1 is loaded on the
semiconductor testing device 10A. As a result, it is
possible to improve the test accuracy. Further, when
the semiconductor device 1 is mounted on a circuit
substrate after the test, the reliability of the
10 electrical connection between the semiconductor device
1 and the circuit substrate can be improved.

Further, as shown in FIG.1, each connection
portion 24A is deformed along the outer surface of a
respective one of the bumps 2 when the semiconductor
15 device 1 is loaded on the semiconductor testing device
10A. Thereby, the contact area between the connection
portion 24A and the bump 2 increases. Thus, it is
possible to ensure the electrical connection
therebetween. The above-mentioned effects/advantages
20 provided in the first embodiment are similarly provided
in each of the other embodiments described later.

FIG.3 shows an arrangement in which the
semiconductor testing device 10A is applied to a
testing socket 30A which is used when the semiconductor
25 device 1 is tested. The semiconductor testing device
10A is set in a body portion 32 of the testing socket
30A. A lid portion 34 is rotatably supported on the
body portion 32 by a shaft 36. This lid portion 34 is
locked in a closed position by a locking pin 38. FIG.3
30 shows the condition in which the lid portion 34 is
locked in the closed position.

In this locked condition, the lid portion 34
presses the semiconductor device 1 onto the
semiconductor testing device 10A. Thereby, as
35 described above, the bumps 2 formed on the
semiconductor device 1 are connected with the
connection portions 24A formed on the semiconductor

1 testing device 10A. The semiconductor testing device
10A is connected with the testing board 40 through the
terminal portions 22 and the connection pins 42. In
this condition, a predetermined test can be performed
5 on the semiconductor device 1 through the testing board
40.

The semiconductor testing device 10A in the
first embodiment can be applied not only to the test of
the semiconductor device 1 using the arrangement shown
10 in FIG.3 but also to wafer contactors 44A and 44B shown
in FIGS.4 and 5, respectively.

These wafer contactors 44A and 44B are used
when a test is performed on a wafer 3 on which a
predetermined electronic circuit is formed and then
15 bumps 2 are formed. Each of the wafer contactors 44A
and 44B includes a wafer holder 46 for holding the
wafer 3 and a base 48.

The wafer 3 is set in the wafer holder 46 in
a position in which the bumps 2 of the wafer 3 project
20 upward, and then, the semiconductor testing device 10A
is loaded on the wafer 3. Then, the base 48 is placed
on the semiconductor testing device 10A. Hooks 47,
projecting downwardly from the base 48, pass through
through holes formed in the wafer holder 46, and the
25 projecting ends of the hooks 47 engage with the bottom
surface of the wafer holder 46. Thus, the base 48 is
locked with the wafer holder 46. Thereby, the base 48
presses the semiconductor testing device 10A onto the
wafer 3. When the locking of the base 48 with the
30 wafer holder 46 is released, each of the hooks 47 is
laterally bent and thereby, the engagement between the
bottom surface of the wafer holder 46 and the
projecting end of the hook 47 is released.

Because the base 48 is smaller than the wafer
35 holder 46, the terminal portions 22 of the
semiconductor testing device 10A are externally
exposed. In the wafer contactor 44A shown in FIG.4,

1 contacts 50 are electrically connected with the exposed
terminal portions 22, respectively. In the wafer
contactor 44B shown in FIG.5, connector 52 is
electrically connected with the exposed terminal
5 portions 22. In this condition, a test is performed on
the wafer 3. Thus, the semiconductor testing device
10A can also be applied to the test of the wafer 3 in
the arrangements shown in FIG.4 and FIG.5. In each of
the arrangements shown in FIGS.4 and 5, advantages
10 similar to those described above can be provided. This
can also be said for the other embodiments described
later.

A second embodiment of the present invention
will now be described.

15 FIGS.6A and 6B show a semiconductor testing
device 10B in the second embodiment of the present
invention. FIG.6A shows a side sectional elevation
view of part of the semiconductor testing device 10B.
FIG.6B shows a bottom view of part of the semiconductor
20 testing device 10B. In FIGS.6A and 6B, for the
components/parts identical to those of the
semiconductor testing device 10A shown in FIGS.1 and 2,
the same reference numerals are given and the
descriptions thereof will be omitted. Hereinafter,
25 although each semiconductor testing device has a
plurality of contact members 18, descriptions will be
made mainly for only one contact member 18 for the sake
of simplification of descriptions.

In the semiconductor testing device 10B in
30 the second embodiment, a connection portion 24B extends
from only one side of the opening 16 so as to have a
cantilever-like shape. Further, a roughened surface 25
is formed at least at an area of the connection portion
24B, at which area the connection portion 24B is
35 connected with the bump 2.

As a result of the connection portion 24B
having the cantilever-like shape, possible deformation

1 of the connection portion 24B can be increased.
Thereby, even if the variation in the heights of the
bumps 2 is large, this can be easily accommodated.
Thereby, a highly reliable test can be performed.
5 Further, because the possible deformation of the
connection portion 24B is large, the contact area
between the connection portion 24B and the bump 2
increases. Thus, it is possible to ensure the
electrical connection therebetween.

10 Further, also by forming the roughened
surface 25 at least at the area at which the connection
portion 24 is connected with the bump 2, it is possible
to ensure the electrical connection therebetween. The
roughened surface 25 has minute unevenness thereon, and
15 thus, the effective surface area is large. When the
bump 2 comes into contact with the connection portion
24B, the minute projections of the roughened surface
protrude into the bump 2. Thereby, electrical
connection between the connection portion 24B and the
20 bump 2 can be ensured.

The roughened surface 25 is formed by, for
example, a method of treating the surface of the
connection portion 24B with chemicals, by blasting or
the like.

25 A third embodiment of the present invention
will now be described.

FIGS. 7A and 7B show a semiconductor testing
device 10C in the third embodiment of the present
invention. FIG. 7A shows a side sectional elevation
30 view of part of the semiconductor testing device 10C.
FIG. 7B shows a bottom view of part of the semiconductor
testing device 10C. Also in FIGS. 7A and 7B, for the
components/parts identical to those of the
semiconductor testing device 10A shown in FIGS. 1 and 2,
35 the same reference numerals are given and the
descriptions thereof will be omitted.

In the semiconductor testing device 10C in

1 the third embodiment, a connection portion 24C includes
one pair of cantilever portions 56. Specifically, the
connection portion 24C includes a ring portion 54, and,
as shown in FIG.7B, the pair of cantilever portions 56
5 extend from opposite sides of the ring portion 54
toward the center of the ring portion.

The possible amount of deformation of the
cantilever portions 56, when the semiconductor device 1
is loaded on the semiconductor testing device 10C and
10 the bump 2 presses the cantilever portions 56, is
larger than the case of the connection portion 24A in
the first embodiment, and is smaller than the case of
the connection portion 24B in the second embodiment.
Accordingly, when the heights of the bumps 2 vary, one
15 of the first, second and third embodiments may be
appropriately selected.

Further, in the third embodiment, since the
cantilever portions 56 come into contact with the bump
2 on two sides as shown in FIG.7A, it is possible to
20 hold the bump 2 more stably in comparison to the case
of the second embodiment. Further, in comparison to
the first embodiment, the mechanical strength of the
connection portion 24C can be increased, and thus,
occurrence of plastic deformation of the connection
25 portion 24C can be prevented.

A fourth embodiment of the present invention
will now be described.

FIGS.8A and 8B show a semiconductor testing
device 10D in the fourth embodiment of the present
30 invention. FIG.8A shows a side sectional elevation
view of part of the semiconductor testing device 10D.
FIG.8B shows a bottom view of part of the semiconductor
testing device 10D. Also in FIGS.8A and 8B, for the
components/parts identical to those of the
35 semiconductor testing device 10A shown in FIGS.1 and 2,
the same reference numerals are given and the
descriptions thereof will be omitted.

1 In the second embodiment, the connection
portion 24B has a flat-plate cantilever shape. In
contrast to this, in the semiconductor testing device
10D in the fourth embodiment, a connection portion 24D
5 is a forked cantilever portion 58. In comparison to
the connection portion 24B in the second embodiment,
the connection portion 24D is more likely to be
deformed. Thereby, the variation of the heights of the
bumps 2 can be effectively accommodated.

10 However, because the connection portion 24D
is likely to be deformed, in a case where the contact
member 18 is made of copper (Cu), plastic deformation
of the connection portion 24D is likely to occur.
Accordingly, in the fourth embodiment, it is preferable
15 that the contact portion 18 (including the connection
portion 24D) is made of a material which has elasticity
and also high electric conductivity.

A fifth embodiment of the present invention
will now be described.

20 FIGS. 9A and 9B show a semiconductor testing
device 10E in the fifth embodiment of the present
invention. FIG. 9A shows a side sectional elevation
view of part of the semiconductor testing device 10E.
FIG. 9B shows a bottom view of part of the semiconductor
25 testing device 10E. Also in FIGS. 9A and 9B, for the
components/parts identical to those of the
semiconductor testing device 10A shown in FIGS. 1 and 2,
the same reference numerals are given and the
descriptions thereof will be omitted.

30 In the semiconductor testing device 10B-10D
in the second through fourth embodiments, each of the
connection portions 24B-24D has a cantilever shape. In
contrast to this, in the semiconductor testing device
10E in the fifth embodiment, a connection portion 24E
35 includes a portion 60 supported on both ends. Each of
the both ends of the portion 60 is integrally connected
with a ring portion 54.

1 By using the portion 60 supported on both
ends, the mechanical strength of the connection portion
20E can be increased. Thereby, the connection portion
20E can be prevented from being degraded due to long-
5 term use.

A sixth embodiment of the present invention
will now be described.

FIGS. 10A and 10B show a semiconductor testing
device 10F in the sixth embodiment of the present
10 invention. FIG. 10A shows a side sectional elevation
view of part of the semiconductor testing device 10F.
FIG. 10B shows a bottom view of part of the
semiconductor testing device 10F. Also in FIGS. 10A and
10B, for the components/parts identical to those of the
15 semiconductor testing device 10A shown in FIGS. 1 and 2,
the same reference numerals are given and the
descriptions thereof will be omitted.

In the sixth embodiment, a connection portion
24F is obtained as a result of forming an opening 63 at
20 the center line of the portion 60 of the connection
portion 24E in the fifth embodiment. Thus, a pair of
portions 62, each supported at both ends, are formed.

By forming the pair of portions 62 in the
connection portion 24F, the amount of deformation of
25 the portions 62 can be increased. Thereby, variation
in the heights of the bumps 2 can be effectively
accommodated.

Further, by providing the opening 63 between
the portions 62, the bottom-end portion of the bump 2
30 is located in the opening 63. Thereby, movement of the
bump 2 on the connection portion 24F can be prevented.
Accordingly, the semiconductor device 1 can be
positively positioned on the semiconductor testing
device 10F.

35 A seventh embodiment of the present invention
will now be described.

FIGS. 11A and 11B show a semiconductor testing

1 device 10G in the seventh embodiment of the present
invention. FIG.11A shows a side sectional elevation
view of part of the semiconductor testing device 10G.
FIG.11B shows a bottom view of part of the
5 semiconductor testing device 10G. Also in FIGS.11A and
11B, for the components/parts identical to those of the
semiconductor testing device 10A shown in FIGS.1 and 2,
the same reference numerals are given and the
descriptions thereof will be omitted.

10 In the above-described first embodiment, the
cross-shaped opening 26A is formed at the center of the
connection portion 24A so that the connection portion
24A is deformable. In contrast to this, in the seventh
15 embodiment, a straight-line slit 26B is formed in a
connection portion 24G of the semiconductor testing
device 10G so that the connection portion 24G is
deformable.

The possible amount of deformation of the
connection portion 24G in the seventh embodiment is
20 less than the possible amount of deformation of the
connection portion 24A in the first embodiment.
However, the mechanical strength of the connection
portion 24G is higher than that of the connection
portion 24A. Accordingly, in accordance with the
25 material of the bump 2 (for example, whether the bump 2
is made of solder or gold, and so forth), an
appropriate one of the slits 26A and 26B may be
selected.

In the seventh embodiment, the connection
30 portion can be easily deformed. As a result, the
variation of the heights of the bumps can be
accommodated as a result of the connection portion
being appropriately deformed. Further, because the
contact area between the connection portion and th
35 bump is increased, a positive electrical connection can
be provided.

An eighth embodiment of the present invention

1 will now be described.

FIGS.12A and 12B show a semiconductor testing device 10H in the eighth embodiment of the present invention. FIG.12A shows a side sectional elevation
5 view of part of the semiconductor testing device 10H. FIG.12B shows a bottom view of part of the semiconductor testing device 10H. Also in FIGS.12A and 12B, for the components/parts identical to those of the semiconductor testing device 10A shown in FIGS.1 and 2,
10 the same reference numerals are given and the descriptions thereof will be omitted.

In the eighth embodiment, a circular opening 26C is formed at the center of a connection portion 24H. The possible amount of deformation of the
15 connection portion 24H is less than that of the connection portion 24G in the seventh embodiment, while the mechanical strength of the connection portion 24H is higher than the connection portion 24G. Accordingly, as mentioned above, an appropriate one of
20 the slits 26A, 26B and the opening 26C may be selected. Further, in the eighth embodiment, because the opening 26C is located at the center of the connection portion 24H and also has a circular shape, the bump 2 is always located at the center of the connection portion 24H.
25 Accordingly, the semiconductor device 1 can be positively positioned on the semiconductor testing device 10H.

In the eighth embodiment, the connection portion can be easily deformed. As a result, the
30 variation of the heights of the bumps can be accommodated as a result of the connection portion being appropriately deformed. Further, because the contact area between the connection portion and the bump is increased, a positive electrical connection can
35 be provided.

A ninth embodiment of the present invention will now be described.

1 FIGS.13A and 13B show a semiconductor testing
d vice 10I in the ninth embodiment of th present
invention. FIG.13A shows a side sectional elevation
view of part of the semiconductor testing device 10I.
5 FIG.13B shows a bottom view of part of the
semiconductor testing device 10I. Also in FIGS.13A and
13B, for the components/parts identical to those of the
semiconductor testing device 10A shown in FIGS.1 and 2,
the same reference numerals are given and the
10 descriptions thereof will be omitted.

 In the ninth embodiment, many small-diameter
circular openings 26D are formed in a connection
portion 24I. By forming a large number of circular
openings 26D in the connection portion 24I, similar to
15 the above-described embodiments, the connection portion
24I is deformable. The possible amount of deformation
can be adjusted by appropriately selecting the number
of the circular openings 26D and the diameter of each
circular opening 26D.

20 Further, by forming the large number of
circular openings 26D, when the bump 2 is pressed onto
the connection portion 24I, the edge of each circular
opening 26D cuts into the bump 2. Therefore, the
connection portion 24I provides an effect the same as
25 that provided by the roughened surface 25 of the second
embodiment. Thereby, electrical connection between the
connection portion 24I and the bump 2 can be ensured.

 In the ninth embodiment, the connection
portion can be easily deformed. As a result, the
30 variation of the heights of the bumps can be
accommodated as a result of the connection portion
being appropriately deformed. Further, because the
contact area between the connection portion and the
bump is increased, a positive electrical connection can
35 be provided.

 A tenth embodiment of the present invention
will now be described.

1 FIGS.14A and 14B show a semiconductor testing
device 10J in th tenth embodiment of the present
invention. FIG.14A shows a side sectional elevation
view of part of the semiconductor testing device 10J.
5 FIG.14B shows a bottom view of part of the
semiconductor testing device 10J. Also in FIGS.14A and
14B, for the components/parts identical to those of the
semiconductor testing device 10A shown in FIGS.1 and 2,
the same reference numerals are given and the
10 descriptions thereof will be omitted.

 In each of the above-described embodiments,
the connection portion is integrally formed in the
contact member 18. In contrast to this, in the tenth
embodiment, a direct-contact part 64 of a connection
15 portion 24J is a member different from the other
portion of the contact member 18.

 By using the different member as the direct-
contact part 64 of the connection portion 24J, it is
possible to separately select the material of the
20 contact member 18 and the material of the direct-
contact part 64. Accordingly, it is possible to select
a material that is optimum for the function of the
contact member 18 and to select a material that is
optimum for the function of the direct-contact part 64.

25 In the semiconductor testing device 10J in
the tenth embodiment, in order to set the possible
amount of deformation of the direct-contact part 64 of
the connection portion 24J to be large, the direct-
contact part 64 is a foil-like terminal. In the tenth
30 embodiment, the foil-like terminal 64 (direct-contact
part) is made of aluminum (Al), and the other portion
of the contact member 18 is made of copper (Cu).

 An eleventh embodiment of the present
invention will now be described.

35 FIGS.15A and 15B show a semiconductor t sting
device 10K in the eleventh embodiment of the present
invention. FIG.15A shows a side sectional elevation

1 view of part of the semiconductor testing device 10K.
FIG.15B shows a bottom view of part of the
semiconductor testing device 10K. Also in FIGS.15A and
15B, for the components/parts identical to those of the
5 semiconductor testing device 10A shown in FIGS.1 and 2,
the same reference numerals are given and the
descriptions thereof will be omitted.

In the eleventh embodiment, similar to the
tenth embodiment, a connection portion 24K is a member
10 different from the other portion of the contact member
18. The connection portion 24K is a direct-contact
part which is a cantilever-shaped wire 66.

The cantilever-shaped wire 66 is formed using
the wire-bonding technique. Specifically, wire bonding
15 is performed at a position on the contact member 18 in
proximity to the opening 16 using a wire-bonding
apparatus. Then, after a predetermined length of wire
is pulled out, the wire is cut. As a result, the wire
is in a condition indicated by the broken line in
20 FIG.15A.

Then, the wire is bent to the side of the
opening 16. Thus, the cantilever-shaped wire 66 is
formed (indicated by the solid line in FIG.15A). By
forming the connection portion 24K using the wire-
25 bonding technique, the connection portion 24K is easily
and efficiently formed, and also, the cost can be
reduced.

Further, in the eleventh embodiment, the
connection portion 24K is the cantilever-shaped wire
30 66, one end of the wire 66 being fixed and the other
end of the wire 66 being free. Thereby, the possible
amount of deformation of the cantilever-shaped wire 66
is relatively large. As a result, even if the
variation of the heights of the bumps 2 is large, the
35 variation can be accommodated.

A twelfth embodiment of the present invention
will now be described.

1 FIGS.16A and 16B show a semiconductor testing
devic 10L in the twelfth embodiment of the present
invention. FIG.16A shows a side sectional elevation
view of part of the semiconductor testing device 10L.
5 FIG.16B shows a bottom view of part of the
semiconductor testing device 10L. Also in FIGS.16A and
16B, for the components/parts identical to those of the
semiconductor testing device 10A shown in FIGS.1 and 2,
the same reference numerals are given and the
10 descriptions thereof will be omitted.

 Also in the twelfth embodiment, similar to
the above-described eleventh embodiment, a direct-
contact part 68 of the connection portion 24L is a
wire. Although the connection portion 24K is the
15 cantilever-shaped wire 66 in the eleventh embodiment,
the direct-contact part 68 of the connection portion
24L is a wire supported at both ends in the twelfth
embodiment.

 The wire 66 supported at both ends is formed
20 also using the wire-bonding technique. Specifically,
first bonding is performed at a position on a frame
portion 54 of the connection portion 24L in proximity
to the opening 16. Then, after the wire is pulled out
a predetermined length, second bonding is performed at
25 a position on the frame portion 54 opposite to the
position of the first bonding. Thereby, each of the
both ends of the wire 68 is fixed to the frame portion
54. The mechanical strength of the connection portion
24L in the twelfth embodiment is higher than that of
30 the connection portion 24L in the eleventh embodiment.

 A thirteenth embodiment of the present
invention will now be described.

 FIG.17 shows a bottom view of part of a
semiconductor testing device 10M in th thirteenth
35 embodiment of th present invention. Also in FIG.17,
for the components/parts identical to those of the
semiconductor t sting device 10A shown in FIGS.1 and 2,

1 the same reference numerals are given and the
descriptions thereof will be omitted.

In the connection portion 24M of the
semiconductor testing device 10M, two of the wires 68,
5 each supported at both ends, as described above for the
twelfth embodiment, are used. The two wires 68 are
arranged so as to form a cross as shown in FIG.17. In
this arrangement in the thirteenth embodiment, the
effect provided by the twelfth embodiment can also be
10 provided, and also, in comparison to the arrangements
of the eleventh and twelfth embodiments shown in
FIGS.15A, 15B, 16A and 16B, movement of the bump 2 can
be prevented. Thereby, the semiconductor device 1 can
be positively positioned on the semiconductor testing
15 device 10M.

A fourteenth embodiment of the present
invention will now be described.

FIG.18 shows part of a semiconductor testing
device 10N in the fourteenth embodiment of the present
20 invention. Also in FIG.18, for the components/parts
identical to those of the semiconductor testing device
10A shown in FIGS.1 and 2, the same reference numerals
are given and the descriptions thereof will be omitted.

In the above-described respective
25 embodiments, basically, each of the semiconductor
testing devices 10A-10M includes the insulating
substrate 14 and the contact member 18. In contrast to
this, in the semiconductor testing device 10N in the
fourteenth embodiment, in addition to the insulating
30 substrate 14 and the contact member 18, a reinforcement
member 70A is provided.

The reinforcement member 70A is made of an
elastic member having an insulating property (for
example, rubber, flexible resin, or the like).
35 Specifically, a holder 72 is provided in this
embodiment. The reinforcement member 70A is provided
on the holder 72, and then, the contact member 18 and

1 the insulating substrate 14 are stacked in the stated
order.

In order to accommodate the variation of the
heights of the bumps 2, it is necessary to form each
5 connection portion 24 to be thin. The contact member
18 is supported on the insulating substrate 14 except
for the positions at which the contact member 18 faces
the openings 16. Thus, the mechanical strength of the
contact member 18 is ensured.

10 It is necessary that the connection portions
24 are electrically connected with the bumps 2. For
this purpose, the openings 16 are formed in the
insulating substrate 14 at the positions at which the
insulating substrate 14 faces the bumps 2. As a
15 result, the thin connection portions 24 are exposed
through the openings 16. Thus, the mechanical strength
of the connection portions 24 is decreased.

In the fourteenth embodiment, the
reinforcement member 70A supports the connection
20 portions 24. Thereby, even if a strong force is
applied to the connection portions 24, the
reinforcement member 70A protects the connection
portions 24. Thereby, plastic deformation of the
connection portions 24 can be prevented. Therefore, a
25 stable test can be always performed.

Further, in the fourteenth embodiment, the
holder 72 is provided under the semiconductor testing
device 10N. This holder 72 is made of a material
having a low elastic deformation rate, such as, for
30 example, metal, hard resin or the like. The holder 72
is provided under the reinforcement member 70A, and
supports the reinforcement member 70A.

As a result of providing the holder 72 for
supporting the reinforcement member 70A, even if
35 lastic deformation of the reinforcement mem b r 70A
occurs when the semiconductor device 1 is loaded on the
s miconductor testing device 10N, excessive deformation

1 of the reinforcement member 70A and shifting of the
reinforcement member 70A from a predetermined position
can be prevented. Thereby, a stable electrical
connection between the connection portions 24 and the
5 bumps 2 can be provided.

A fifteenth embodiment of the present
invention will now be described.

FIG.19 shows part of a semiconductor testing
device 10P in the fifteenth embodiment of the present
10 invention. In FIG.19, for the components/parts
identical to those of the semiconductor testing devices
10A and 10N in the first and fourteenth embodiments,
shown in FIGS.1, 2 and 18, the same reference numerals
are given and the descriptions thereof will be omitted.

15 In the semiconductor testing device 10P in
the fifteenth embodiment, projections 74 are formed on
a reinforcement member 70B at positions at which the
reinforcement member 70B faces the connection portions
24.

20 By forming the projections 74 on the
reinforcement member 70B at the positions at which the
reinforcement member 70B faces the connection portions
24, the projections 74 are mainly deformed and the
other portion of the reinforcement member 70B is not
25 much deformed, when a strong force is applied to the
connection portions 24. As a result, excessive
deformation of the reinforcement member 70B and
shifting of the reinforcement member 70B from a
predetermined position can be prevented.

30 In each of the arrangements shown in FIGS.18
and 19, when the connection portions 24 are deformed as
a result of an external force being applied to the
connection portions 24, the reinforcement member 70A or
70B, which is in contact with the connecting portions
35 24, prevents excess deformation of the connection
portions 24. Thus, the connection portions 24 are well
protected.

1 A sixteenth embodiment of the present
inv ntion will now be d scribed.

5 FIG.20 shows part of a semiconductor testing
device 10Q in the sixteenth embodiment of the present
invention. In FIG.20, for the components/parts
identical to those of the semiconductor testing devices
10A and 10N in the first and fourteenth embodiments,
shown in FIGS.1, 2 and 18, the same reference numerals
are given and the descriptions thereof will be omitted.

10 In the semiconductor testing device 10Q in
the sixteenth embodiment, reverse-conical depressions
76 are provided on the reinforcement member 70C at the
positions at which the reinforcement member 70C faces
the connection portions 24.

15 By forming the reverse-conical depressions 76
on the reinforcement member 70C at the positions at
which the reinforcement member 70C faces the connection
portions 24, in addition to the openings 16 formed in
the insulating substrate 14, positioning of the bumps 2
20 can be performed using the reverse-conical depressions
76. Accordingly, positioning of the semiconductor
device 1 with respect to the semiconductor testing
device 10Q can be positively performed.

25 Because of the shape of the reverse-conical
depression 76, the wall thereof is a taper surface.
Accordingly, in comparison to a cylindrical depression
or a rectangular depression each having a vertical
wall, the connection portion 24 immediately comes into
contact with the reinforcement member 70C when the
30 connection portion 24 is deformed. Thereby, it is
possible to prevent plastic deformation of the
connection portion 24.

 A seventeenth embodiment of the present
invention will now be described.

35 FIG.21 shows part of a semiconductor t sting
device 10R in the seventeenth embodiment of the present
invention. In FIG.21, for the components/parts

1 identical to those of the semiconductor testing devices
10A and 10N in the first and fourteenth embodiments,
shown in FIGS. 1, 2 and 18, the same reference numerals
are given and the descriptions thereof will be omitted.

5 The semiconductor testing device 10R in the
seventeenth embodiment uses an anisotropic conductive
rubber as a reinforcement member 70D. The anisotropic
conductive rubber is made as a result of mixing
10 conductive metal powder into a flexible insulating
material, and has characteristics of having
conductivity in a pressed direction, that is, in the
direction of a force application.

Accordingly, by using the anisotropic
conductive rubber as the reinforcement member 70D, the
15 reinforcement member 70D has two functions. The first
function is to mechanically reinforce the connection
portions 24. The second function is to electrically
connect the connection portions 24 with pads 78
provided on the testing board 40.

20 Thereby, plastic deformation of the connection portions
24 can be prevented by the mechanically reinforcing
function, and also, various kinds of wiring of the
semiconductor testing device 10R can be performed by
the electrically conductive function.

25 An eighteenth embodiment of the present
invention will now be described.

FIG. 22A shows a side sectional elevation view
of part of a semiconductor testing device 10S in the
eighteenth embodiment of the present invention.

30 FIG. 22B shows a bottom view of part of the
semiconductor testing device 10S. In FIGS. 22A and 22B,
for the components/parts identical to those of the
semiconductor testing devices 10A and 10N in the first
and fourteenth embodiments, shown in FIGS. 1, 2 and 18,
35 the same reference numerals are given and the
descriptions thereof will be omitted.

In the semiconductor testing device 10S in

1 the eighteenth embodiment, a plurality of long and
narrow through holes or slots 80 are formed in a
reinforcement member 70E. The holes or slots 80 are
formed approximately parallel with each other as shown
5 in FIG.22B.

By forming the long and narrow through holes
or slots 80 in the reinforcement member 70E, when the
reinforcement member 70E is deformed as a result of the
bumps 2 pressing the connection portions 24, the
10 deformation is absorbed as a result of the long and
narrow through holes or slots 80 being deformed. That
is, when deformation occurs in portions 81A, 81B and
81C which are defined by the long and narrow holes or
slots 80, the deformation of each portion does not
15 interact with the adjacent portions. Thereby,
electrical connection between the connection portions
24 and the bumps 2 can be positively ensured.

A nineteenth embodiment of the present
invention will now be described.

20 FIG.23 shows a bottom view of part of a
semiconductor testing device 10T in the nineteenth
embodiment of the present invention. In FIG.23, for
the components/parts identical to those of the
semiconductor testing devices 10A and 10N in the first
25 and fourteenth embodiments, shown in FIGS.1, 2 and 18,
the same reference numerals are given and the
descriptions thereof will be omitted.

In the semiconductor testing device 10T in
the nineteenth embodiment, a net-shaped elastic member
30 is used as a reinforcement member 70F. This net-shaped
elastic member 70F is made from, for example, elastic
wires (insulating wires) which are woven to have a net
shape. Therefore, the reinforcement member 70F is
flexibly deformed when a pressing force is applied
35 thereto. This reinforcement member 70F is provided on
the entire bottom surface of the insulating substrate
14 including the bottom surfaces of the connection

1 portions 24.

In the nineteenth embodiment, by using the net-shaped elastic member as the reinforcement member 70F, in comparison to the arrangements of the
5 fourteenth through eighteenth embodiments shown in FIGS.18-22B, a space required for providing the reinforcement member 70F can be reduced. Thereby, the semiconductor testing device 10T can be miniaturized. Further, in comparison to the block-shaped
10 reinforcement members 70A-70E, the cost can also be reduced.

A twentieth embodiment of the present invention will now be described.

FIG.24 shows a side sectional elevation view
15 of part of a semiconductor testing device 10U in the twentieth embodiment of the present invention. In FIG.24, for the components/parts identical to those of the semiconductor testing devices 10A and 10N in the first and fourteenth embodiments, shown in FIGS.1, 2
20 and 18, the same reference numerals are given and the descriptions thereof will be omitted.

In the twentieth embodiment, a balloon-shaped member which contains air or a liquid is used as a reinforcement member 70G. In this embodiment, the
25 balloon-shaped member contains air. The balloon-shaped member 70G is connected to, for example, an air supply means such as an air pump. Air is supplied to the balloon-shaped reinforcement member 70G by the air supply means. This balloon-shaped reinforcement member
30 70G is provided in a depression formed in a holder 72. The insulating substrate 14 with the contact member 18 is placed on the balloon-shaped reinforcement member 70G, as shown in the figure.

In the above-described semiconductor testing
35 device 10U, by adjusting the amount of air contained in the balloon-shaped reinforcement member 70G, the elastic force of the balloon-shaped reinforcement

1 memb r 70G can be adjusted. Thereby, it is possible to
set th elastic force of the balloon-shaped
reinforcement member 70G to be appropriate for
accommodating the variation of the heights of the bumps
5 2 and plastic deformation of the connection portions 24
can be prevented.

Further, by intentionally increasing and
decreasing the internal pressure of the balloon-shaped
reinforcement member 70G after the bumps 2 are
10 connected to the connection portions 24, the connection
portions 24 slide on the bumps 2, respectively.
Thereby, even if oxide film and/or dust are present on
the surfaces of the bumps 2 and the connection portions
24, the oxide film and/or dust are removed as a result
15 of the wiping effect provided by the sliding movement.
Thereby, it is possible to make the surfaces of the
bumps 2 and the connection portions 24 be in a good
condition.

A twenty-first embodiment of the present
20 invention will now be described.

FIG.25 shows the twenty-first embodiment. In
this embodiment, the semiconductor testing device 10U
in the twentieth embodiment shown in FIG.24 is applied
to a testing socket 30B. In FIG.25, for the
25 components/parts identical to those of the
semiconductor testing devices 10A and 10U in the first
and twentieth embodiments, shown in FIGS.1, 2 and 24,
the same reference numerals are given and the
descriptions thereof will be omitted.

30 As shown in FIG.25, the balloon-shaped
reinforcement member 70G of the semiconductor testing
device 10U is contained in the depression formed in the
holder 72 which is a part of the testing socket 30B.
The testing sock t 30B includes a lid portion 34 which
35 is rotatably supported by a base member, which is fixed
on a testing board 40, through a shaft 36. The lid
portion 34 can be locked in the closed position by a

1 locking pin (not shown in th figure). FIG.25 shows
th closed position of the lid portion 34.

In this locked state, the lid portion 34
presses the semiconductor device 1 onto the
5 semiconductor testing device 10U. Thereby, as
described above, the bumps 2 formed on the
semiconductor device 1 are connected with the
connection portions 24 formed on the semiconductor
testing device 10U. The semiconductor testing device
10 10U is connected with the testing board 40 through the
terminal portions 22 and contacts 84. In this
condition, a predetermined test can be performed on the
semiconductor device 1 through the testing board 40.

A pipe 86, which is connected with a high-
15 pressure air source, is connected with the balloon-
shaped reinforcement member 70G. At a middle position
of the pipe 86 between the high-pressure air source and
the balloon-shaped reinforcement member 70G, a valve
device 88 is provided. This valve device 88 is, for
20 example, a three-way valve. The valve device can
switch the mode thereof between a mode (hereinafter,
referred to as a 'supply mode') in which high-pressure
air is supplied to the balloon-shaped reinforcement
member 70G and a mode (hereinafter, referred to as a
25 'discharge mode') in which air in the balloon-shaped
reinforcement member 70G is discharged.

By appropriately switching the mode of the
valve device 88 between the supply mode and the
discharge mode as a result of controlling the valve
30 device 88, it is possible to control the internal
pressure of the balloon-shaped reinforcement member 70G
to a desired pressure, and the above-mentioned wiping
effect can be provided.

A twenty-second embodiment of the present
35 invention will now be described.

FIG.26 shows a side sectional elevation view
of part of a semiconductor testing device 10V in the

1 twenty-second embodiment of the present invention. In
FIG. 26, for the components/parts identical to those of
the semiconductor testing device 10A in the first
embodiment, shown in FIGS. 1 and 2, the same reference
5 numerals are given and the descriptions thereof will be
omitted.

In the semiconductor testing device 10V in
the twenty-second embodiment, an insulating substrate
14A on which a contact member 18A is provided and an
10 insulating substrate 14B on which a contact member 18B
is provided are stacked with one another.

By using such a stacked-layer arrangement, a
connection portion 24P of the contact member 18A is
used for connecting with a bump 2A, a connection
15 portion 24N of the contact member 18B is used for
connecting with a bump 2B, and so forth. Thus, it is
possible to reduce the number of bumps 2 (2A, 2B) which
are connected with each layer (with the connection
portions of each insulating substrate).

20 Thereby, variable wiring arrangements of the
contact member 18A or 18B of each layer (on each
insulating substrate 14A or 14B) can be provided.
Accordingly, for the semiconductor device 1 which is of
high density and has many bumps 2, an adequate
25 semiconductor testing device 10V can be provided.

FIGS. 27A, 27B and 28 show a semiconductor
testing device 110A in a twenty-third embodiment of the
present invention. FIGS. 27A and 27B illustrate the
arrangement and operation of the semiconductor testing
30 device 110A. FIG. 28 shows a condition in which a
contactor 111 is separate from a wiring substrate 115A.

As shown in the respective figures, in
general, the semiconductor testing device 110A includes
the contactor 111 and the wiring substrate 115A. A
35 semiconductor device 120 is loaded on the semiconductor
testing device 110A, a spherical connection terminal
(referred to as a bump, hereinafter) 121 provided on

1 the semiconductor device 120 is electrically connected
with the semiconductor testing device 110A, and a
predetermined test is performed on the semiconductor
device 120 through the semiconductor testing device
5 110A.

In general, the contactor 111 includes a
contact portion 112A, and an insulating substrate 113.
The contact portion 112A is a tongue-shaped member,
and, is formed of an elastically deformable conductive
10 metal film such as a copper (Cu), an alloy of copper,
or the like, for example. The contact portion 112A is
provided at a position facing the bump 121 provided on
the semiconductor device 120.

One end portion of the contact portion 112A
15 is fixed to the insulating substrate 113, which will be
described later, and the other end portion of the
contact portion 112A extends on an opening 114 which is
formed in the insulating substrate 113. Therefore, the
contact portion 112A is supported and extends like a
20 cantilever on the opening 114. Approximately the
middle of the contact portion 112A is a connection
portion 124A with which the bump 121 is connected.

The insulating substrate 113 is a single-
layer, sheet-shaped resin substrate made of a resin,
25 having the property of insulation, such as polyimide
(PI) or the like, for example. The above-described
contact portion 112A is formed on the top of the
insulating substrate 113, and is supported by the
insulating substrate 113. The opening 114 mentioned
30 above is formed in the insulating substrate 113 at a
position facing the contact portion 112. Forming of
the contact portion 112A on the insulating substrate
113 can be performed easily at a low cost, because a
technique of manufacturing a flexible substrate or the
35 like can be used.

The insulating substrate may comprise a
flexible film made of resin and having the property of

1 insulation, and the contact portion may comprise a
conductive metal layer having flexibility.

The wiring substrate 115A has a multilayer
substrate arrangement, and includes a plurality (two,
5 in the embodiment) of insulating layers 116A, 116B, and
an internal connection terminal 117 (first connection
terminal), an external connection terminal 118 (second
connection terminal) and an interposer 119, which are
formed in the insulating layers 116A, 116B, and so
10 forth.

The insulating layers 116A, 116B are made of
an insulating material such as glass epoxy or the like,
for example. Further, the internal connection terminal
117, external connection terminal 118 and interposer
15 119 are formed through a plating technique, for
example, in the insulating layers 116A, 116B. As the
material of the internal connection terminal 117,
external connection terminal 118 and interposer 119, a
copper (Cu) is used.

20 The internal connection terminal 117 is
formed on the surface (referred to as a top surface,
hereinafter) of the wiring substrate 115A, on which
surface the contactor 111 is loaded, at a position
facing the contact portion 112A provided on the
25 contactor 111. Accordingly, in the condition in which
the contactor 111 is loaded on the wiring substrate
115A, the internal connection terminal 117 faces the
contact portion 112A via the opening 114.

The external connection terminal 118 is
30 formed on the surface (referred to as a bottom surface,
hereinafter) opposite to the above-mentioned top
surface of the wiring substrate 115A. The external
connection terminal 118 is a terminal which is used for
connecting the semiconductor testing device 110A with a
35 semiconductor tester or the like which performs an
operation test on the semiconductor device 120.

The interposer 119 is used for electrically

1 connecting the internal connection terminal 117 with
the external connection terminal 118. The interposer
119 includes a plurality of internal electric wires
119A, 119B and 119C. As a result of the internal
5 connection terminal 117 and the external connection
terminal 118 being connected with one another through
the interposer 119, it is possible to improve
flexibility in the position at which the internal
connection terminal 117 is formed and the position at
10 which the external connection terminal 118 is formed,
such that these positions can be set arbitrarily.

The operation of the above-described
semiconductor testing device 110A at a time of test
will now be described. FIG. 27A shows a condition
15 before the semiconductor device 120 is loaded on the
semiconductor testing device 110A. In this embodiment,
because the contact portion 112A has a cantilever-like
arrangement, the contact portion 112A extends
approximately straightly over the opening 114 before
20 the semiconductor device 120 is loaded on the
semiconductor testing device 110A. (Hereinafter, the
condition shown in FIG. 27A will be referred to as a
before-loaded condition.)

When the semiconductor device 120 is loaded
25 on the semiconductor testing device 110A in the before-
loaded condition, during the loading process, the bump
121 is inserted into the opening 114. As a result, the
contact portion 112A, which is made of an elastic
material and has a cantilever-like arrangement, is
30 elastically deformed, as shown in FIG. 27B, and, thus,
the extending end 125 of the contact portion 112A comes
into contact with the internal connection terminal 117
of the wiring substrate 115A. Thereby, the bump 121 is
electrically connected with the external connection
35 terminal 118 via the contact portion 112A, internal
connection terminal 117 and interposer 119.

A plurality of contact portions 112A, which

1 are provided on the insulating substrat 113 for a
plurality of bumps 121 of th semiconductor device 120,
respectively, are formed independently. Therefore,
when the bumps 121 are inserted into the insulating
5 substrate 113, the respective contact portions 112A are
lowered independently. As a result, even when there is
variation in the heights of the bumps 121, the
respective contact portions 112A are deformed in
proportion to the individual heights of the bumps 121,
10 respectively. Thereby, it is possible to cause the
contact portion 112A to be stably connected with the
internal connection terminal 117.

Thus, in this embodiment, the internal
connection terminal 117, which is connected with the
15 contact portion 112A, is electrically connected with
the external connection terminal 118 via the interposer
119, which is provided in the wiring substrate 115A.
As a result, by appropriately arranging the interposer
119, it is possible to arbitrarily set a wiring path
20 for electrically connecting the internal connection
terminal 117 with the external connection terminal 118.

Thus, as a result of the wiring path from the
contact portion 112A to the external connection
terminal 118 being formed not in the contactor 111 but
25 in the wiring substrate 115A, it is not necessary to
produce a multilayer contactor, and the single-layer
contactor 111 can be used. Thus, it is possible to
reduce the cost of the contactor 111.

Further, a glass epoxy substrate, which is
30 generally used as a wiring substrate in electronic
equipment, can be used as the wiring substrate 115A.
Therefore, it is possible to reduce the cost of the
wiring substrate 115A. As a result, it is possible to
reduce the cost of the semiconductor testing device
35 110A.

Further, the contact portion 112A provided in
the contactor 111 causes an electric signal from the

1 semiconductor device 120 to directly flow to the wiring
substrate 115A. Therefore, even when the pitch of the
bumps 21 is reduced, it is not necessary to provide
electric wires 108A between membrane terminals 106A-1
5 and 106A-2 (see FIG. 30). Accordingly, in the
arrangement of this embodiment, it is possible to
shorten the wire length between the internal connection
terminal 117 and the external connection terminal 118,
and to simplify the wiring arrangement, and, as a
10 result, it is possible to use the semiconductor testing
device 110A in a high-speed electrical test.

In the first embodiment, the wiring substrate
comprises a multi-layer substrate. As a result, it is
possible to achieve the contactor with a minute pitch
15 of the contact portions, and, also, it is possible to
provide the semiconductor testing device which can be
used for a high-speed test.

Further, the semiconductor testing device
110A has an arrangement such as, as shown in FIG. 28,
20 to permit installation and removal of the contactor 111
onto and from the wiring substrate 115A. Thereby, when
the contact portion 112A is degraded as a result of the
semiconductor testing device 110A being used repeatedly
for testing many semiconductor devices 120, the
25 contactor 111 is replaced with a new one. Thereby, it
is possible to maintain reliability of the test
performed on the semiconductor devices 120.

As a result of the cost of the contactor 111
being reduced, as mentioned above, when replacement of
30 the contactor 111 is needed, it is possible to perform
replacement at a low cost. Therefore, the cost
required for the maintenance can be reduced.

Advantages of the twenty-third embodiment
will now be described in detail.

35 Recently, a highly integrated and high-
density semiconductor device having spherical
connection terminals (bumps) has been produced. As a

1 result, bump size and pitch of the semiconductor device
hav been a greatly reduced. Therefore, achievement of
a high-accuracy contactor which can come into contact
with an arrangement of minute terminals of the
5 semiconductor device, and maintenance of stable
electrical connection with the minute terminals have
been very important objects.

Further, as the pitch of the terminals of the
semiconductor is reduced, it is necessary to use a
10 multilayer wiring. Thereby the cost of the minute-
pitch contactor increases.

Generally speaking, a semiconductor testing
device has a contactor which is used for electrical
connection with a semiconductor device. The contactors
15 provided in the semiconductor testing devices are
classified into so-called pogo-pin type ones in which
pins come into contact with terminals of the
semiconductor device using spring forces, and membrane-
type ones in which spherical-surface terminals which
20 are to be connected with the spherical connection
terminals (bumps) are formed on a thin insulation film
through, for example, plating or the like.

FIG. 29A shows a pogo-pin type semiconductor
testing device 101A. In the semiconductor testing
25 device 101A, coil springs 103 are provided through a
pair of substrates 102a, 102b. By using the elastic
forces of the coil springs 103, pogo pins 104 are
lifted and lowered, and, thus, the pogo pins 104 come
into contact with the bumps (not shown in the figure)
30 provided on the semiconductor device.

However, because the coil springs 103 are
used in the semiconductor testing device 101A, it is
not possible to use the semiconductor testing device
101A for a high-density semiconductor device. In order
35 to eliminate this problem, the membrane-type
semiconductor testing device 101B has been developed.

The membrane-type semiconductor testing

1 device 101B has a contactor in which spherical-surface
terminals 106A (which is referred to as membrane
terminals) are formed through plating. The membrane
terminals 106A are connected with the bumps (not shown
5 in the figure) of the semiconductor device, and a test
of the semiconductor device is performed.

Further, on the top surface of an insulating
substrate 105A, the electric wires 108A, which are
connected with the membrane terminals 106A,
10 respectively, are formed. The electric wires 108A
connected with the membrane terminals 106A extend to
peripheral positions of the insulating substrate 105A.
Further, an elastic member 109A is provided below the
contactor, and, even if variation in the heights of the
15 bumps of the semiconductor device exists, positive
electrical connection is achieved as a result of the
elastic member 109A being elastically deformed
appropriately.

However, in the membrane-type semiconductor
20 testing device 101B, the electric wires 108A are laid
on the top surface of the insulating substrate 105A.
As a result, as the terminal pitch is reduced, it is
not possible to provide a sufficient area in which the
electric wires 108A are laid.

25 That is, in the arrangement in which the
electric wires 108A are laid only on the top surface of
the insulating substrate 105A, when a high-density
semiconductor testing device 101B is produced, the
pitch between each pair of adjacent membrane terminals
30 106A is reduced, and, also, the number of electric
wires 108A increases. Therefore, as shown in FIG. 30,
it is necessary to provide many electric wires 108A
between adjacent membrane terminals 106A. In the
example shown in FIG. 30, three wires are provided
35 between the membrane terminals 106A-1 and 106A-2.
However, the number of electric wires 108A which can be
provided between the pair of adjacent membrane

1 terminals 106A-1, 106A-2, the pitch of which is
reduced, is naturally limited.

Therefore, as in a semiconductor testing
device 101C shown in FIG. 31, provision of a multilayer
5 contactor can be considered. In the semiconductor
testing device 101C shown in the figure, 3 layers of
insulating substrates 105B are stacked. On each
insulating substrate 105B, an electric wire 108B is
formed. Further, below the contactor, an elastic
10 member 109B is provided, and, even if variation in the
heights of the bumps of the semiconductor device
exists, positive electrical connection can be achieved
as a result of the elastic member 109B being
elastically deformed appropriately.

15 In this arrangement, the electric wire 108B
is formed on each insulating substrate 105B.
Therefore, flexibility in layout of the electric wires
108B is improved, and, therefore, it is possible to
widen the pitch between adjacent electric wires 108B.
20 Accordingly, when the pitch between adjacent membrane
terminals 106B is reduced, it is possible to widen the
space between adjacent electric wires 108B. As a
result, the semiconductor testing device 101C can be
used for a high-density semiconductor device.

25 However, manufacturing of the contactor as a
result of the plurality of insulating substrates 105B
and the membrane terminals 106B being stacked is
technically very difficult, and development thereof is
difficult. As a result, when such an arrangement is
30 manufactured, the contactor is very expensive.

Further in the membrane-type semiconductor
testing device 101C, generally, when the membrane
terminals 106B are degraded (movement of solder,
adhesion of foreign bodies, etc.), or damaged, due to
35 connection with the bumps, the contactor is replaced.
However, when the contactor is expensive as mentioned
above, the cost required for testing a semiconductor

1 device is very high.

In order to eliminate these problems, a method of providing a contactor of one layer or two layers, providing an anisotropic conductive rubber
5 below the contactor, and connecting the anisotropic conductive rubber with the contactor can be considered. However, the anisotropic conductive rubber is very expensive, there is a limit to reduction of the pitch of a minute-pitch arrangement, and, also, durability
10 thereof is not sufficient.

The twenty-third embodiment is directed to elimination of the above-described problems. In this embodiment, it is possible to provide a high-density, low-cost semiconductor testing device.

15 A twenty-fourth embodiment of the present invention will now be described.

FIG. 32 shows a semiconductor testing device 110B in the twenty-fourth embodiment of the present invention. In FIG. 32, the same reference numerals are
20 given to parts/portions the same as those of the semiconductor testing device 110A in the twenty-third embodiment shown in FIGS. 27A, 27B and 28, and descriptions thereof are omitted. To respective embodiments (twenty-fifth through thirty-third
25 embodiments), which will be described later, the same manner is applied.

In the semiconductor testing device 110B in this embodiment, a contact portion 112B has a thickness or a hardness such that, when the bump 121 is connected
30 with the contact portion 112B, the contact portion 112B can break the oxide film formed on the surface of the bump 121.

As is well known, in a case where the bump 121 is made of solder, the oxide film is formed on the
35 surface of the bump 121. Because the oxide film has the property of insulation, the electric connectability between the bump 121 and the contact portion 112B is

1 degraded when the oxide film formed is 1 μ m as it is.

As a result of the thickness or the hardness
of the contact portion 112B being increased, as in this
embodiment, the contact portion 112B is able to break
5 the oxide film formed on the surface of the bump 121.
More specifically, when the semiconductor device 120 is
loaded on the contactor 111 and the bump 121 slides on
the contact portion 112B along the surface of the
contact portion 112B, the contact portion 112B wipes
10 the bump 121, and can break the oxide film on the bump
121.

Thereby, it is possible to improve the
electrical connectability between the contact portion
112B and the bump 121, and a stable contact condition
15 can be maintained during the test. As a specific
example of the contact portion 112B, in a case where a
copper (Cu) is used as the material thereof, it is
possible to break the oxide film as a result of the
thickness of the contact portion 112B being on the
20 order of 15 μ m through 200 μ m.

The twenty-fifth embodiment of the present
invention will now be described.

FIGS. 33A and 33B show a semiconductor
testing device 110C in the twenty-fifth embodiment of
25 the present invention. In the semiconductor testing
device 110C, an extending portion 122 is formed in the
opening 114. Specifically, as shown in FIG. 33B, the
extending portion 122 extends inside of the opening 114
by a length indicated by L from the edge of the opening
30 114.

The extending portion 122 is formed
integrally with the insulating substrate 113, at the
position facing the contact portion 112A. The contact
portion 112A is partially supported by the extending
35 portion 122.

As a result of providing the extending
portion 122 which partially supports the contact

1 portion 112A, it is possible to adjust the reaction
force which is developed in the contact portion 112A as
a result of the contact portion 112A being pushed by
the bump 121. The adjustment of the reaction force can
5 be performed as a result of the length L of the
extending portion 122 being adjusted. As the extending
portion 122 is elongated, the contact portion 112A is
not likely to bend, and the reaction force increases.
Conversely, as the extending portion 122 is shortened,
10 the reaction force decreases.

Thus, in this embodiment, the contact
pressure developed between the contact portion 112A and
the bump 121 when the semiconductor device 120 is
loaded on the contactor 111 can be adjusted to an
15 appropriate value. Thereby, it is possible that the
contact portion 112A and the bumps are connected with
one another in a good condition.

The twenty-sixth embodiment of the present
invention will now be described.

20 FIG. 34 shows a semiconductor testing device
110D in the twenty-sixth embodiment of the present
invention. In the semiconductor testing device 110D, a
projection 123A, which comes into contact with the
contact portion 112A, is formed in the opening 114.

25 As a result of the projection 123A being
formed in the opening 114, when the contact portion
112A is bent and thus a first portion of the contact
portion 112A is moved as a result of the first portion
being pushed by the bump 121 at the time of connection,
30 the contact portion 112A comes into contact with the
projection 123A at a certain height (the height of the
projection 123A), and a second portion of the contact
portion 112A is further moved, which second portion is
a portion extending from a position to the extending
35 end 125 of the contact portion 112A, at which position
the contact portion 112A is supported by the projection
123A. Accordingly, as a result of adjusting the height

1 and the position of the projection 123A, it is possible
to adjust the contact pressure which is applied to the
bump 121 by the contact portion 112A. As a result, it
is possible to achieve the contact pressure which is
5 optimum for the electrical connection between the
contact portion 112A and the bump 121. Thereby, it is
possible that the contact portion 112A and the bump 121
are connected with one another in a good condition.

This projection 123A can be made of a
10 conductive metal (for example, gold, palladium, nickel,
or the like), resin (for example, polyimide, epoxy, or
the like), or an elastic material (for example, a
conductive rubber in which carbon or the like is mixed,
a sponge, or the like).

15 When the projection 123A is made of a
conductive material, electrical connection between the
contact portion 112A and the internal connection
terminal 117 can be performed not only through the
extending end 125 of the contact portion 112A but also
20 through the projection 123A. As a result, it is
possible to positively perform the electrical
connection between the contact portion 112A and the
internal connection terminal 117.

When the projection 123A is made of an
25 elastic material, as a result of the hardness of the
projection 123A being adjusted, it is possible that an
appropriate contact pressure is developed between the
bump 121 and the contact portion 112A. Thereby, stable
electrical connection can be achieved.

30 Further, in addition to the reaction force
developed in the contact portion 112A when the bump 121
pushes the contact portion 112A, the elastic
restoration force developed as a result of the
projection 123A itself being lastically deformed is
35 applied to the bump 121 as the reaction force.
Therefore, in this embodiment, even in a case where a
sufficient contact pressure cannot be obtained only by

1 the reaction force developed in the contact portion
112A, the contact pressure required for an appropriate
electrical connection can be positively developed by
the projection 123A. As a result, it is possible to
5 achieve stable electrical connection.

The adjustment of the contact pressure can be
performed in the range of hardness H_R C10 through 100
as a result of the hardness of the material and/or the
height of the projection 123A being adjusted.
10 appropriately.

In the case where the projection 123A is made
of metal, the projection 123A can be formed through
plating, wire bonding, or the like, for example. In
the case where the projection 123A is made of resin,
15 the projection 123A can be formed through potting or
the like, for example.

When the projection 123A is formed through
plating, in a case where the contactor 111 is used for
testing the semiconductor device 120 on which a pattern
20 is formed with a narrow pitch and the bumps are
provided in high density, respective projections 123A
can be manufactured in high accuracy, in comparison to
a case where respective projections 123A are formed
through adhesion.

25 When the projection 123A is formed through
wire bonding, because it is possible to use an existing
wire bonder, it is possible to form the projection 123A
at a low cost. Further, for a case where merely a
small number of semiconductor testing devices are
30 produced for each type, it is possible to perform
production for the respective types flexibly.

Further, when the projection 123A is formed
through potting, because the projection 123A can be
formed through inexpensive equipment, it is possible to
35 reduce the cost required for forming the projection
123A. Further, for a case where merely a small number
of semiconductor testing devices are produced for each

1 type, it is possible to perform production for the
respective types flexibly.

The twenty-seventh and twenty-eighth
embodiments of the present invention will now be
5 described.

FIG. 35 shows a semiconductor testing device
110E in the twenty-seventh embodiment of the present
invention. FIG. 36 shows a semiconductor testing
device 110F in the twenty-eighth embodiment of the
10 present invention. In the semiconductor testing device
110E, a spherical projection 123B is used. In the
semiconductor testing device 110F, a ring-shaped
projection 123C (for example, an O ring) is used.

As a result of the spherical projection 123B
15 or the ring-shaped projection 123C being used, it is
possible to provide the projection 123B or 123C in the
opening 114 easily. Each of the projections 123B and
123C has a function similar to that of the projection
123A in the twenty-sixth embodiment, and, also,
20 materials and properties the same as those of the
projection 123A can be applied to each of the
projections 123B and 123C.

The shape of the contact portion will now be
considered. In each of the twenty-third through
25 twenty-eighth embodiments, the contact portion 112A or
112B has a simple tongue-like shape. However, the
contact portion is used for the electrical connection
with the internal connection terminal 117. Therefore,
as a result of appropriately changing the shape of the
30 contact portion, it is possible to improve the
electrical connectability between the contact portion
and the internal connection terminal 117. Variant
examples of the shape of the contact portion will now
be described.

35 FIGS. 37A and 37B show contact portions 112C
and 112D which are first and second variant examples,
respectively. A pointed-end portion is formed at an

1 extending-end portion of each of the contact portions
112C and 112D so that the electrical connectability
with the internal connection terminal 117 is improved.

5 A point portion 125A as the pointed-end
portion is formed at the extending-end portion of the
contact portion 112C shown in FIG. 37A. As a result of
the point portion 125A being formed at the extending-
end portion of the contact portion 112C and thus being
sharpened sharply, the point portion 125A sticks in or
10 slides on the internal connection terminal 117, so that
the oxide film formed on the surface of the internal
connection terminal 117 can be broken. As a result, it
is possible to perform stable electrical connection
between the contact portion 112C and the internal
15 connection terminal 117. The point portion 125A can be
formed through etching or the like, for example.

A saw-tooth portion 125B is formed as the
pointed-end portion at the extending-end portion of the
contact portion 112D shown in FIG. 37B. As a result of
20 the saw-tooth portion 125B being formed at the
extending-end portion of the contact portion 125B and
thus many point portions being provided there, it is
possible that the oxide film formed on the surface of
the internal connection terminal 117 is broken at a
25 plurality of positions. Thereby, more stable
electrical connection can be performed between the
contact portion 112D and the internal connection
terminal 117. This saw-tooth portion 125B can also be
formed through etching or the like.

30 With reference to FIGS. 38A through 48,
contact portions 112E through 112P, which are third
through thirteenth variant examples, respectively, will
now be described. FIGS. 38A, 39A, 40A, 41A, 42A, 43A,
44A, 45A, 46A and 47A show side elevational sectional
35 views of the contact portions 112E through 112N,
respectively, and FIGS. 38B, 39B, 40B, 41B, 42B, 43B,
44B, 45B, 46B and 47B show bottom views of essential

1 portions of the contact portions 112E through 112N,
respectively.

When the contactor provided with each of the
third through twelfth variant examples of the contact
5 portions is provided on the wiring substrate 115A, as
shown in FIG. 38A, spacers 170 are provided between the
contactor provided with the contact portion and the
wiring substrate 115A provided with the internal
connection terminal 117. When the bump 121 is inserted
10 into the opening 114, the connection portion of the
contact portion is deformed and comes into contact with
the internal connection terminal 117, as shown in the
figure. For the sake of simplification, the spacers
170, internal connection terminal 117 and the
15 insulating layers 116A, 116B will be omitted in FIGS.
39A, 40A, 41A, 42A, 43A, 44A, 45A, 46A and 47A.

FIGS. 38A and 38B show the contact portion
112E which is the third variant example. In this
variant example, the contact portion 112E includes a
20 pair of cantilever portions 156. Specifically, a ring
portion 154 is formed at a connection portion 124B of
the contact portion 112E, and, as shown in FIG. 38B,
the pair of cantilever portions 156 extend from
opposite positions of the ring portion 154 toward the
25 center of the ring portion 154.

In this variant example, at a time of
testing, the cantilever portions 156 come into contact
with the bump 121 at both sides thereof. Thereby, it
is possible that the bump 121 is held stably.
30 Therefore, it is possible to increase the strength of
the connection portion 124B, and it is possible to
prevent the connection portion 124B from being deformed
plastically.

FIGS. 39A and 39B show the contact portion
35 112F which is the fourth variant example. In this
variant example, a connection portion 124C is a forked
cantilever portion 158. In this variant example, the

1 connection portion 124C is likely to be deformed. As a
result, even if variation in the height of the bump 121
exists, positive electrical connection is achieved as a
result of the connection portion 124C being deformed
5 appropriately.

However, because the connection portion 124C
is likely to be deformed, in a case where the contact
portion 112F is made of copper (Cu), plastic
deformation of the connection portion 124C is likely to
10 occur. Accordingly, in this variant example, it is
preferable that the contact portion 112F be made of a
material which has elasticity and also high electric
conductivity.

FIGS. 40A and 40B show the contact portion
15 112G which is the fifth variant example. Each of the
above-described contact portions 112A through 112F has
a cantilever shape. In contrast to this, the contact
portion 112G of this variant example includes a portion
160 supported at both ends thereof.

20 Specifically, a connection portion 124D has
the portion 160 supported at both ends thereof, and
each of both ends of the portion 160 is integrally
connected with a ring portion 154. As a result of the
connection portion 124D having the portion 160
25 supported at both ends thereof, the mechanical strength
of the connection portion 124D can be increased.
Thereby, the connection portion 124D can be prevented
from being degraded due to long-term use.

FIGS. 41A and 41B show the contact portion
30 112H which is the sixth variant example. In the
contact portion 112H of this variant example, an
opening (slit) 163 is formed at the center line of the
connection portion 124E. Thus, a pair of portions 162,
each supported at both ends thereof, are formed. By
35 forming the pair of portions 162 in the connection
portion 124E, the amount of deformation of the portions
162 can be increased. Thereby, variation in the height

1 of the bump 121 can be effectively accommodated.

Further, by providing the opening 163 between the portions 162, a bottom-end portion of the bump 121 is located in the opening 163 in the loaded condition. Thereby, movement of the bump 121 on the connection portion 124E can be prevented. Accordingly, the bump 121 (semiconductor device 120) can be positively positioned on the contact portion 112H (contactor 111).

In the sixth variant example, a bottom portion of the bump is inserted into the opening 163 when the bump is connected with the contact portion. Thereby, it is possible to control occurrence of deformation of the bottom portion of the bump. Further, because the contact area between the bump and the contact portion increases, it is possible to achieve positive electrical connection between the bump and the contact portion.

FIGS. 42A and 42B show the contact portion 112I which is the seventh variant example. In the contact portion 112I of the seventh variant example, a straight-line slit 126A is formed in a connection portion 124F so that the connection portion 124F is deformable.

The possible amount of deformation of the connection portion 124F of this variant example is less than the possible amount of deformation of the connection portion 124E of the sixth variant example. However, the mechanical strength of the connection portion 124F is higher than that of the connection portion 124E. Accordingly, in accordance with the material of the bump 121 (for example, whether the bump 2 is made of solder or gold, and so forth), an appropriate one of the connection portions 124E and 124F may be selected.

In the seventh variant example, a bottom portion of the bump is inserted into the slit 126A when the bump is connected with the contact portion.

1 Ther by, it is possible to control occurrence of
deformation of the bottom portion of the bump.
Further, because the contact area between the bump and
the contact portion increases, it is possible to
5 achieve positive electrical connection between the bump
and the contact portion.

FIGS. 43A and 43B show the contact portion
112J which is the eighth variant example. In this
variant example, a circular opening 126B is formed at
10 the center of a connection portion 124G. The possible
amount of deformation of the connection portion 124G is
less than that of the connection portion 124F in the
seventh variant example, while the mechanical strength
of the connection portion 124G is higher than the
15 connection portion 124F. Accordingly, as mentioned
above, an appropriate one of the connection portions
124E, 124F and 124G may be selected. Further, because
the opening 126B is located at the center of the
connection portion 124G and also has the circular
20 shape, the bump 121 is always located at the center of
the connection portion 124G. Accordingly, the bump 121
(semiconductor device 120) can be positively positioned
on the contact portion 112J (contactor 111).

In the eighth variant example, a bottom
25 portion of the bump is inserted into the opening 126B
when the bump is connected with the contact portion.
Thereby, it is possible to control occurrence of
deformation of the bottom portion of the bump.
Further, because the contact area between the bump and
30 the contact portion increases, it is possible to
achieve positive electrical connection between the bump
and the contact portion.

FIGS. 44A and 44B show the contact portion
112K which is the ninth variant example. In this
35 variant example, many small-diameter circular openings
126C are formed in a connection portion 124H. By
forming the large number of circular openings 126C in

1 the connection portion 124H, similar to the above-
described variant examples, the connection portion 124H
is deformable. The possible amount of deformation can
be adjusted by appropriately selecting the number of
5 the circular openings 126C and the diameter of each
circular opening 126C.

Further, by forming the large number of
circular openings 126C, when the bump 121 is pressed
onto the connection portion 124H, the edges of many of
10 the circular openings 26D come into contact with and
cut into the bump 2. Thereby, the electrical
connectability between the connection portion 124H and
the bump 121 can be improved.

FIGS. 45A and 45B show the contact portion
15 112L which is the tenth variant example. In the above-
described respective variant examples, the connection
portions 124B through 124H are integrally formed in the
contact portions 112E through 112K, respectively. In
contrast to this, in this variant example, a connection
20 portion 124I is a member different from the contact
portion 112L.

By using the connection portion 124I which is
the member different from the contact portion 112L, it
is possible to separately select the material of the
25 contact portion 112L and the material of the connection
portion 124I. Accordingly, it is possible to select a
material that is optimum for the function of the
contact portion 112L and to select a material that is
optimum for the function of the connection portion
30 124I. In the contact portion 112L shown in FIGS. 45A
and 45B, in order to set the possible amount of
deformation of the connection portion 124I to be large,
the connection portion 124I is a foil-like terminal
164. In this variant example, the foil-like terminal
35 164 is made of aluminum (Al), and the contact portion
112L is made of copper (Cu).

FIGS. 46A and 46B show the contact portion

1 112M which is the eleventh variant example. In this
variant example, similar to the above-described tenth
variant example, a connection portion 124J is a member
different from the contact portion 112M. In this
5 variant example, as shown in the figures, the
connection portion 124J is a cantilever-shaped wire
166.

The cantilever-shaped wire 166 is formed
using the wire-bonding technique. Specifically, wire
10 bonding is performed at a position on the contact
portion 112M in close proximity to the opening 114
using a wire-bonding apparatus. Then, after a
predetermined length of wire is pulled out, the wire is
cut. As a result, the wire is in a condition indicated
15 by the broken line in FIG.46A.

Then, the wire is bent to a position below
the opening 114. Thus, the cantilever-shaped wire 166
is formed (indicated by the solid line in FIG.46A). By
forming the connection portion 124J using the wire-
20 bonding technique, the connection portion 124J is
easily and efficiently formed, and also, the cost
therefor can be reduced. In this variant example, the
connection portion 124J is the cantilever-shaped wire
166, one end of the wire 166 being fixed and the other
25 end of the wire 166 being free. Thereby, the possible
amount of deformation of the cantilever-shaped wire 166
is relatively large. As a result, even if the
variation of the height of the bump 121 is large, the
variation can be accommodated.

30 FIGS. 47A and 47B show the contact portion
112N which is the twelfth variant example. In this
variant example, similar to the above-described
eleventh variant example, the connection portion 124K
is a wire 168. Although the connection portion 124J is
35 th cantilever-shaped wire 166 in the eleventh variant
example, the connection portion 124K is the wire 168
supported at both ends thereof in the twelfth variant

1 xample.

 The wire 166 supported at both ends thereof
is formed also using the wire-bonding technique.
Specifically, first bonding is performed at a position
5 on a frame portion 154 of the contact portion 112N in
close proximity to the opening 114. Then, after the
wire is pulled out a predetermined length, second
bonding is performed at a position on the frame portion
154 opposite to the position of the first bonding.
10 Thereby, each of the both ends of the wire 168 is fixed
to the frame portion 154. By this arrangement, the
mechanical strength of the connection portion 124K in
the twelfth variant example is higher than that of the
connection portion 124J in the eleventh variant
15 example.

 Although the single wire 168 supported at
both ends thereof is used in this variant example, two
wires 168, each supported at both ends thereof, may be
used. The two wires 168 are arranged so as to cross to
20 form a cross shape. In this arrangement, the effect
provided by the twelfth variant example can also be
provided, and, also, movement of the bump 121 can be
prevented. Accordingly, the bump 121 (semiconductor
device 120) can be positively positioned on the contact
25 portion (contact 111).

 FIG. 48 shows the contact portion 112P which
is the thirteenth variant example. In this variant
example, roughened surfaces 127A are formed on the top
surface (the surface with which the bump 121 comes into
30 contact) and the portion (the bottom surface) which
comes into contact with the internal connection
terminal 117, respectively, of the contact portion
112P. Further, a roughened surface 127B is formed on
the top surface of the internal connection terminal
35 117. The roughened surfaces 127A, 127B may be formed
as a result of forming minute projections by changing a
plating condition; as a result of roughening these

1 surfaces by striking small particles against these
surfac s through blast; as result of stamping on these
surfaces using a member having a roughened surface, or
the like.

5 In this variant example, in the case where
the roughened surface 127A is formed on the top surface
of the contact portion 112P, the oxide film formed on
the surface of the bump 121 is broken by the roughened
surface 127A when the bump 121 is connected with the
10 contact portion 112P. Thereby, stable electrical
connection can be provided between the contact portion
112P and the bump 121.

In the case where the roughened surface 127A
is formed on the portion (the bottom surface) which
15 comes into contact with the internal connection
terminal 117, the oxide film formed on the surface of
the internal connection terminal 117 is broken by the
roughened surface 127A when the contact portion 112P
comes into contact with the internal connection
20 terminal 117. Thereby, stable electrical connection
can be provided between the contact portion 112P and
the internal connection terminal 117.

Further, as a result of the roughened surface
127B being formed on the internal connection terminal
25 117, even if the oxide film is formed on the contact
portion 112P, this oxide film can be broken by the
roughened surface 127B when the contact portion 112P
comes into contact with the internal connection
terminal 117. Thereby, stable electrical connection
30 can be provided between the contact portion 112P and
the internal connection terminal 117.

When each of the roughened surfaces 127A,
127B has the average roughness of 0.1 through 100 μm ,
the effects provided by the roughened surfaces are
35 large.

Further, in the thirteenth variant example
shown in FIG. 48, the roughened surface 127A is formed

1 on each of both top and bottom surfaces of the contact
portion 112P. However, it is also possible that the
roughened surface 127A is formed on only one of the top
and bottom surfaces of the contact portion 112P.
5 Further, although the roughened surface 127B is formed
on the entire surface of the internal connection
terminal 117 in the thirteenth variant example, it is
also possible that the roughened surface 127b is formed
only on the area with which the contact portion 112P is
10 connected.

The twenty-ninth and thirtieth embodiments of
the present invention will now be described.

FIG. 49 shows a semiconductor testing device
110G in the twenty-ninth embodiment of the present
15 invention. FIG. 50 shows a semiconductor testing
device 110H in the thirtieth embodiment of the present
invention. In each of these embodiments, a positioning
arrangement, for positioning of the contactor 111 with
respect to the wiring substrate 115A when the contactor
20 111 is loaded on the wiring substrate 115A, is
provided.

As described above with reference to FIG. 28,
the semiconductor testing device has an arrangement
such as to permit installation and removal of the
25 contactor 111 onto and from the wiring substrate 115A.
Thereby, when the contact portion is degraded as a
result of the semiconductor testing device being used
repeatedly for testing many semiconductor devices 120,
the contactor 111 is replaced with a new one. Thereby,
30 it is possible to always perform stable testing. When
the contactor 111 is replaced with a new one, it is
necessary to accurately position the contact portion
with respect to the internal connection terminal 117.
Therefore, it is necessary to accurately load the
35 contactor 111 on the wiring substrate 115A. For this
purpose, in each of the semiconductor testing devices
110G, 110H in the twenty-ninth and thirtieth

1 embodiments, the positioning arrangement for
positioning the contactor 111 with respect to the
wiring substrate 115A is provided.

5 In the semiconductor testing device 110G
shown in FIG. 49, the positioning arrangement includes
first positioning holes 129 formed in the insulating
substrate 113 of the contactor 111, second positioning
holes 130 formed in the wiring substrate 115A, and
positioning pins 131 which engage with the respective
10 positioning holes 129, 130. Positioning of the
contactor 111 (contact portion 112A) with respect to
the wiring substrate 115A (internal connection terminal
117) is performed as a result of each of the
positioning pins 131 being inserted into, so as to be
15 fitted into, the respective one of positioning holes
129 and the respective one of the positioning holes 130
simultaneously so that the positioning pins 131 engage
with the positioning holes 129, 130.

20 In the semiconductor device 110H shown in
FIG. 50, the positioning arrangement includes
positioning holes 132 formed in the insulating
substrate 113 and positioning projections 133 formed on
the top surface of the wiring substrate 115A.
Positioning of the contactor 111 (contact portion 112A)
25 with respect to the wiring substrate 115A (internal
connection terminal 117) is performed as a result of
the positioning projections 133 being inserted into, so
as to be caused to engage with, the positioning holes
132, respectively.

30 In each of the semiconductor testing devices
110G and 110H in the respective embodiments, merely
through a process of causing the positioning pins 131
to engage with the positioning holes 129, 130, or
merely through a process of causing the positioning
35 projections 133 to engage with the positioning holes
132, it is possible to position the contactor 111 with
respect to the wiring substrate 115A. Therefore,

1 through the simple arrangement and simple operation,
positioning of the contact portion 112A with respect to
the internal connection terminal 117 can be positively
performed.

5 Thus, positioning of the opening and the
contact portion provided in the contactor with respect
to the internal connection terminal provided on the
wiring substrate can be easily and positively
performed.

10 Each of these positioning holes 129, 130, 132
may be formed through drilling, punching, or etching,
or using a laser. Further, if it is necessary to
perform positioning more accurately than the above-
described positioning methods, it is possible that a
15 positioning arrangement includes a camera, an image
recognizing unit, and so forth, so that positioning is
performed through image recognition.

The thirty-first embodiment of the present
invention will now be described.

20 FIG. 51 shows a semiconductor testing device
110I in the thirty-first embodiment of the present
invention. In this embodiment, only the opening 114 is
provided at a position at which no electrical
connection between the contactor 111 and the bump 121
25 is necessary, that is, a non-connection portion 134
having no contact portion 112A is provided.

The semiconductor device 120 loaded on the
semiconductor testing device 110I has many bumps 121.
However, as is well known, when a test is performed on
30 this semiconductor device 120, all the bumps 121 are
not necessarily used for causing test signals to flow
therethrough. (Hereinafter, the bumps, which are not
used for causing test signals to flow therethrough,
will be referred to as connection-unnecessary bumps
35 121A.)

In this embodiment, the non-connection
portion 134, for which no contact portion 112A is

1 provided, is provided at the position facing the
conn ction-unnecessary bump 121A. Thereby, th
connection-unnecessary bump 121A do not come into
contact with a contact portion 112A. As a result of
5 the non-connection portion 134 being provided, the
connection-unnecessary bump 121A is merely located in
the opening 114 and does not come into contact with the
contact 111 when the semiconductor device 120 is
loaded on the semiconductor testing device 110I.

10 Therefore, the connection-unnecessary bump
121A can be prevented from being deformed in the non-
connection portion 134. Further, the reaction force
developed in the contact portion 112A does not exist in
the non-connection portion 134. Therefore, the pushing
15 force to be applied to the semiconductor device 120, by
which force the semiconductor device 120 is pushed to
the semiconductor testing device 110I when the
semiconductor device 120 is loaded on the semiconductor
testing device 110I, can be reduced. As a result, the
20 loading work is easier.

The thirty-second embodiment of the present
invention will now be described.

FIG. 52 shows a partial plan view of the
semiconductor testing device 110J in the thirty-second
25 embodiment of the present invention. As shown in the
figure, in the semiconductor testing device 110J in
this embodiment, a direction in which each contact
portion 112A extends is a direction normal to a
direction toward the center position (the center
30 position of the semiconductor device) in a condition in
which the semiconductor device has been loaded on the
semiconductor testing device 110J.

This will now be described by considering the
contact portion 112A-1 shown in the figure as an
35 example. When a line segment X is drawn b tween the
center position of the semiconductor device and the
center position of the contact portion 112A-1, the

1 direction in which the contact portion 112A-1 extends,
that is, the direction in which the extending end 125
of the contact portion 112A-1 faces, is the direction
indicated by the arrow Y. The direction indicated by
5 the arrow Y is perpendicular to the line segment X.
Thus, each contact portion 112A is arranged so as to
line on a circumference of an imaginary circle, the
center of which circle is the center position of the
semiconductor device.

10 The contactor 111 and the semiconductor
device 120 have inherent rates of thermal expansion,
and the rate of thermal expansion of the contactor 111
is different from the rate of thermal expansion of the
semiconductor device 120. Therefore, when a test, such
15 as burn-in, in which heating is performed, is
conducted, a difference occurs in the amounts of
thermal expansion between the contactor 111 and the
semiconductor device 120. When the difference occurs
in the amounts of thermal expansion between the
20 contactor 111 and the semiconductor device 120,
relative displacement occurs between the bumps 121
provided on the semiconductor device 120 and the
contact portions 112A provided on the contactor 111,
respectively.

25 However, as a result of the semiconductor
testing device 110J having the above-described
arrangement, directions of the relative displacement
occurring between the bumps 121 and the contact
portions 112A are the directions in which respective
30 line segments X extend, that is, radial directions.
Therefore, even if the relative displacement occurs
between the bumps 121 and contact portions 112A, it is
possible to keep the contact pressures developed
between the bumps 121 and the contact portions 112A,
35 respectively, constant. This is because, in this case,
the directions of the relative displacement occurring
between the bumps 121 and the contact portions 112A,

1 r spectiv ly, are the dir ctions along the widths of
the contact portions 112A. As a result, the contact
pressures developed between the bumps 121 and the
contact portions 112A, respectively, do not change,
5 even when the relative displacement occurs. Therefore,
the above-described arrangement in which the direction
in which each contact portion 112A extends, that is,
the direction in which the extending end 125 of the
contact portion 112A faces, is the direction indicated
10 by the arrow Y, shown in FIG. 52, enables stable
electrical connection to be maintained.

Further, it is also possible that the
direction in which each contact portion 112A extends,
that is, the direction in which the extending end 125
15 of the contact portion 112A faces, is the direction in
which the line segment X, shown in FIG. 52, extends.
In this case, it is possible to prevent the bumps 121
from separating from the contact portions 112A,
respectively. This is because, in this case, the
20 directions of the relative displacement occurring
between the bumps 121 and the contact portions 112A are
the directions indicated by the arrows Y1 and Y2, shown
in FIG. 27B. Because the directions indicated by the
arrows Y1 and Y2, shown in FIG. 27B, are the
25 longitudinal directions of the contact portion 112A,
the bump 121 is not likely to separate from the contact
portion 112A, even when the relative displacement
occurs. Therefore, the above-described arrangement in
which the direction in which each contact portion 112A
30 extends, that is, the direction in which the extending
end 125 of the contact portion 112A faces, is the
direction in which the line segment X, shown in FIG.
52, extends enables stable electrical connection to be
maintained.

35 Thus, the direction in which the contact
portion extends may be set based on the directions of
relative displacement occurring between the respective

1 one of the spherical connection terminals (bumps) and
the contact portion due to a difference in thermal
expansion between the contactor and the semiconductor
device. Thereby, it is possible to set the direction
5 in which the contact portion extends so that the
contact pressure developed between the spherical
connection terminal and the contact portion is
prevented from changing due to the relative
displacement. Specifically, the direction in which the
10 contact portion extends is set to a direction which is
perpendicular to the directions of the relative
displacement. As a result, the contact pressure
developed between the spherical connection terminal and
the contact portion can be prevented from changing,
15 and, thus, stable connection can be maintained.
Alternatively, it is also possible to set the direction
in which the contact portion extends so that the
spherical connection terminal is prevented from
separating from the contact portion due to the relative
20 displacement. Specifically, the direction in which the
contact portion extends is set to a direction
corresponding to the directions of the relative
displacement. As a result, the spherical connection
terminal can be prevented from separating from the
25 contact portion, and, thus, a stable connection can be
maintained.

The thirty-third embodiment of the present
invention will now be described.

FIGS. 53A and 53B show a semiconductor
30 testing device 110K in the thirty-third embodiment of
the present invention. In this embodiment, a single
layer of wiring substrate 115B is used, and a contact
portion 112R is previously connected with the internal
connection terminal 117.

35 As mentioned above, recently, the
semiconductor device 120 operates at high speed. In
response thereto, signals used in testing of the

1 semiconductor device 120 flow at high speed. Thus, it
is important to protect the testing from entrance of
disturbance. For this purpose, there is a case where a
partial circuit of a semiconductor tester used in
5 testing of the semiconductor device 120 is provided on
the semiconductor testing device 110K. Electronic
components 138, shown in FIGS. 53A, 53B, include the
partial circuit of the semiconductor tester.

As locations at which the electronic
10 components 138 are provided, the contactor 111 or the
wiring substrate 115B may be considered. However, it
is very difficult to provide the electronic components
138 on the contactor 111 which is a membrane substrate,
and, also, the cost required therefor is high.
15 Further, when the electronic components 138 are
provided on the contactor 111, it is necessary to
provide electronic wires for the electronic components
138 on the insulating substrate 113 other than the
contact portion 112R. Thereby, a problem occurs, that
20 is, it is not possible to achieve a high-density
arrangement.

Therefore, in this embodiment, the electronic
components 138 are provided on the wiring substrate
115B. Further, in order to achieve high-speed
25 transmission of a test signal and to prevent entrance
of disturbance, it is necessary to reduce the wiring
length of the interposer between the internal
connection terminal 117 and the external connection
terminal 118 as much as possible. For this purpose, in
30 this embodiment, the single-layer substrate is used as
the wiring substrate 115B so that the wiring length is
reduced. Electrical connection between the internal
connection terminal 117 and the external connection
terminal 118 is provided by using a through-hole
35 conductor 136 formed in an insulating layer 116.

As a result of the contact portion 112R being
previously connected with the internal connection

1 terminal 117, the contact portion 112R is not bent each
time the bump 121 is inserted into the opening 114.
Thereby, brittle fracture of the contact portion 112R,
at the position at which the contact portion 112R is in
5 contact with the periphery of the opening 114, can be
prevented. As a result, it is possible to elongate the
life of the contactor 111.

The spherical connection terminal of the
semiconductor device is not limited to the bump made of
10 solder. It is also possible that, in the semiconductor
device, for which the present invention can be used,
another material (gold, copper, or the like, for
example) is used as the material of the spherical
connection terminal. Further, it is also possible
15 that, in the semiconductor device, for which the
present invention can be used, a connection terminal
other than the spherical connection terminal (a stud-
shaped bump, for example) can be used, alternatively.

Further, the wiring substrate is not limited
20 to a substrate made of a resin such as glass epoxy. It
is also possible to use a substrate made of another
material, such as a ceramic substrate or the like.

Further, the present invention is not limited
to the above-described embodiments, and variations and
25 modifications may be made without departing from the
scope of the present invention.

The contents of the basic Japanese Patent
Application Nos.9-255786 and 10-263579, filed on
September 19, 1997 and September 17, 1998,
30 respectively, are hereby incorporated by reference.